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A NEW SPECIES OF *DIAPTOMUS* FROM LOUISIANA AND TEXAS WITH NOTES ON THE SUBGENUS
LEPTODIAPTOMUS
(COPEPODA, CALANOIDA)

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The new species of *Diaptomus* for which the diagnosis is given herein has been known to me for some time from slides of dissected appendages in the S. F. Light accession in the United States National Museum. These appendages were from copepods collected in south-eastern Texas by Dr. Edward S. Deevey. Since no more material was available it was impossible to characterize the species adequately, although it was apparent that it was related to the *signicauda* group of the subgenus *Leptodiaptomus*. A collection recently made in Louisiana by Dr. Walter G. Moore of Loyola University contained specimens agreeing with this form in the structure of the appendages, and verifying its position in the *signicauda* group by the presence in the female of a distal process on the right side of the genital segment.

The species is named for Dr. Moore whose interest in the fresh-water invertebrates of Louisiana has previously revealed two other new species of *Diaptomus* (M. S. Wilson and Moore 1953a, b) and added much valuable material to study collections.

DIAPTOMUS (LEPTODIAPTOMUS) MOOREI, sp. nov.

Specimens Examined.—Type lot: twenty-one ♀♀ (two ovigerous), five ♂♂, shallow, muddy roadside pond, Louisiana highway 20, 12 miles south of Natchitoches, Natchitoches Parish, Louisiana, April 10, 1953, W. G. Moore. Associated with *D. pallidus* Herrick. Holotype ♀, United States National Museum catalog number 96023; allotype ♂, number 96024.

One ♀, non-ovigerous; ditch pond, U. S. highway 71, south of Lebeau, St. Landry Parish, Louisiana, April 5, 1951, W. G. Moore. Associated with *D. virginianensis* Marsh, *D. louisianensis* M. S. Wilson and Moore and *Osphranticum labronectum* S. A. Forbes.

Slide from Light collection, United States National Museum, ♂ leg 5 and right antennule; ♀ leg 5. Pond in swampy area ("Gum Swamp"), Walker County, Texas, May 11, 1940, E. S. Deevey. Associated with *D. clavipes* Schacht and *Osphranticum labronectum*.

Diagnosis.—With these characters of the subgenus *Leptodiaptomus*: one seta on segments 11 and 13-19 of female and left male antennules. Right antennule male, segment 14 without spinous process. Maxilliped slender, setae of distal portion not clawlike; four setae on distal lobe of basal segment. Leg 2 with Schmeil's organ on endopod segment 2 of both sexes. Leg 5 of female with third segment of exopod not developed and two setae on endopod. Leg 5 of male:

both processes of left exopod 2 short and digitiform, with rounded ends, the inner placed medially; pads of left exopod 2 both medial and well defined, without deep constriction between them; lateral spine of right exopod 2 not inserted on the same plane as that of the segment, strongly directed backwards; left basipod 2 with pronounced crosswise grooving of medial inner margin; claw of right leg at least as long as exopod.

Length, ♀ 1.27-1.32 mm; ♂ 1.15 mm. Greatest width of metasome in both sexes in segments 2 and 3. Segment 5 of female (lateral view) not swollen dorsally. Metasomal wings (fig. 1) only a little asymmetrical, not expanded laterally, inner part rounded but not enlarged into prominent lobes, distal outer corner produced posteriorly; sensilla minute. Urosome female (figs. 1, 2) two-segmented; genital segment with small cuticular lobe at distal outer portion of right side; proximal part with prominent lateral protrusions, that of left side larger and more rounded than that of right; anal segment and caudal rami subequal in length; caudal rami ciliate on inner margin. Urosome male (fig. 4) with segments 3 and 4 a little asymmetrical; segments 2, 3 and 4 with groups of spinules on dorsal, posterior surfaces. Spermatophore elongate; when attached, reaching beyond caudal rami of female (fig. 2). Ovisacs containing 16 and 17 small eggs respectively.

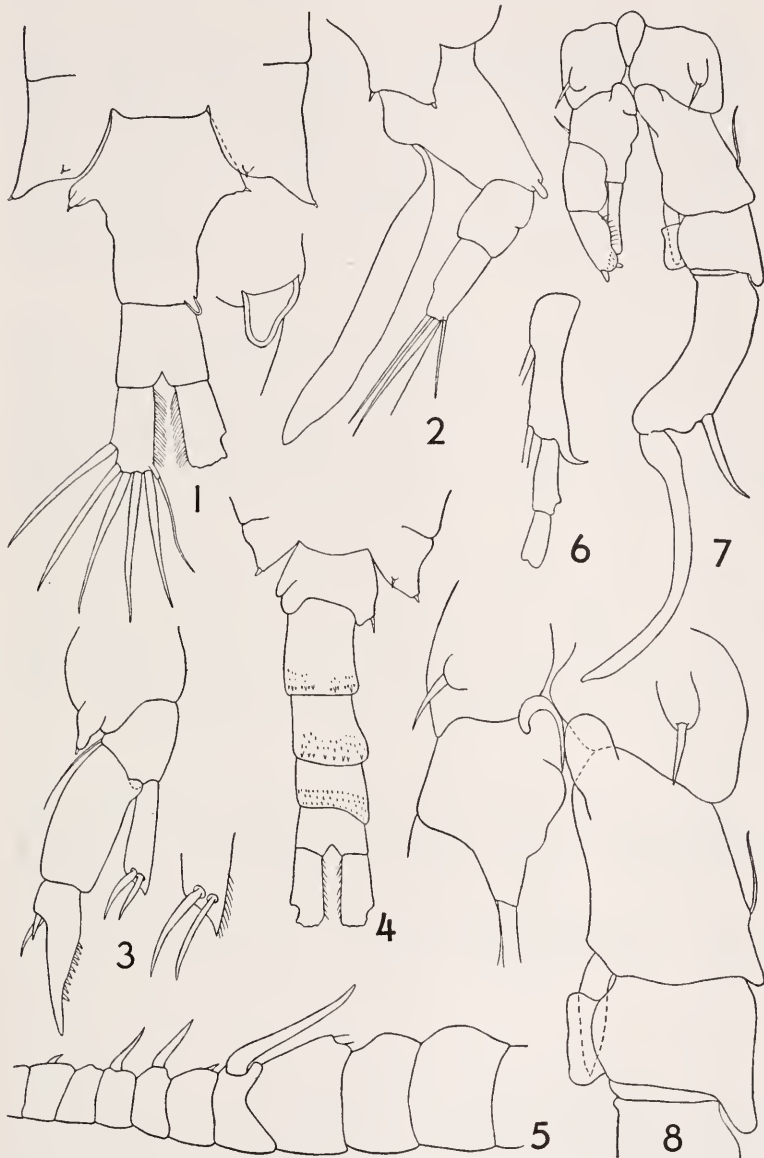
Antennules of female reaching beyond end of caudal rami. Right antennule of male (fig. 5) with spine of segment 8 not enlarged, that on 13 longer than that on 11 and reaching a little beyond segment 14. Proportions of spines to the segmental width and to one another:

Segment	10	11	13
Segment width	12	12	16
Spine length	10	12	29

Process of segment 23 (fig. 6) not reaching to middle of segment 24, the apex strongly outcurved.

Leg 5, female (fig. 3). Basal sensillum minute, on enlarged papilliform protrusion. Length of exopod segments 1 and 2 subequal; exopod with two lateral unequal setae. Endopod nearly as long as inner margin of exopod 1, the inner prolongation sharply pointed, the subequal setae a little less than half the length of the endopod (9:19).

Leg 5, male (figs. 7, 8). Left leg reaching to end of right exopod 1. Basal sensilla of both legs elongate and slender, on enlarged papilliform protrusions. Second basipod segments of both right and left legs with prominent inner protrusions of proximal portion. That of right basipod an upwardly projecting membranous process; the left an upward projection with sclerotized margin, the area of the usual inner groove posterior to this projection swollen marginally. Right exopod segment 1 with large hyaline lamella, subrectangular in shape, attached to midportion of segment and projecting mesiad.



Figures 1-8. *Diaptomus moorei*, sp. nov. Female: 1. metasomal wings and urosome with detail distal process of genital segment, dorsal view; 2. same, lateral view, specimen with attached spermatophore; 3. leg 5, with detail endopod setae. Male: 4. metasomal wings and urosome, dorsal view; 5. right antennule, spines of segments 8-16; 6. same, apical segments; 7. leg 5, posterior view; 8. same, detail basipods and right exopod 1.

Lateral spine of right exopod 2 strongly directed posteriorly, distally placed at a point about 89 percent of total length of segment; its length greater than the width of the segment. Claw a little longer than exopod, evenly curved, hardly tapered beyond the slightly swollen proximal portion so that its width is not greatly reduced throughout; tip blunt. Left exopod segments subequal to one another; processes of segment 2 subequal, the distal a little less than one-fourth length of segment. Right endopod not enlarged, a little shorter than first exopod segment; the left reaching just beyond the middle of second exopod segment.

NOTES ON THE SUBGENUS *Leptodiaptomus*

The subgenus *Leptodiaptomus* is the largest in number of species and the most widely spread group of diaptomids in North America. It is also represented in eastern Asia by *angustilobus* Sars (1898), and by *tyrrelli* Poppe which was reported from Kamchatka by Smirnov (1931). Since other leptodiaptomids occur in Alaska and northern Canada (*pribilofensis*, *nudus*, *sicilis*, *asblandi*) it is possible that further investigation in the little known area of northern Asia may reveal their presence there.

A new key to the North American calanoid species has been prepared for the forthcoming revised edition of Ward and Whipple's *Fresh-Water Biology*. This includes synonyms, summary of distribution, and new illustrations of both sexes of all the known species of *Leptodiaptomus*. It is hoped that this will considerably clarify the confusion that has existed in the literature on this group. In this present paper, therefore, only the taxonomy of *moorei* will be discussed.

Some points, however, should be made on the nomenclature of the subgenus. As pointed out elsewhere (M. S. Wilson, 1951), *Psychrodiaptomus* Kiefer (1938) proposed for *angustilobus*, is a synonym of *Leptodiaptomus* Light (1938). In addition, the name *Eutrichodiaptomus* Light (1939) should also be placed in its synonymy. This subgenus was proposed for *asblandi*, but I fail to find in comparative study of all the species of the group, any structural differences of subgeneric value separating it from the other species of *Leptodiaptomus*.

Also, there is in my mind a question as to whether the subgenus *Pelorodiaptomus* Light (1939) proposed for *trybomi*, should be maintained. This species has never been found since the original collection and accurate knowledge of much of its detail is still lacking. The only specimens available in North America are in the Schacht slide collection in the Illinois State Natural History Survey. These are from the type lot and consist of two females and one male. These slides have been studied and new drawings of the female prepared for the key in Ward and Whipple. The male fifth leg was so mounted that the relationship of pertinent parts could not be entirely clarified to my satisfaction. However, none of the characters ob-

served in this study indicates any sharp departure from basic leptodiptomid structure. One of the most striking differences, but one not of subgeneric value, is the exceptional length of the sensilla (sensory spines) of the basal segments in the fifth legs of both sexes. Oddly, this distinctive character in the female has never been noted in literature. In this, as well as all other characters, *trybomi* appears to present an extreme or bizarre development of the structures found in leptodiptomid species. The problem cannot be fully clarified without additional unmounted specimens, and until such time as they are available for study, the status of *Pelorodiptomus* is uncertain. Examination of the type material shows, however, that the species is distinct, not synonymous with *judayi* nor "a chimaera based upon poorly preserved material" as suggested by Kincaid (1953).

Comparative studies of leptodiptomid species reveal within the subgenus some natural groups which are held together by combinations of several minor structural distinctions. *Diaptomus moorei* is referable to one of these groups which includes *signicauda* Lilljeborg, *novamexicanus* Herrick and *nudus* Marsh. The characters indicating the close relationship of these species are:

(1) Presence in the female of a distal process on the right side of the genital segment, which is also characterized by rather prominent lateral protrusions of the area bearing the sensilla.

(2) Endopod of the female fifth leg not swollen or rounded distally, but instead produced into a sharply pointed projection beyond the insertion of the setae.

(3) The process of the twenty-third segment of the male right antennule very short (not reaching beyond middle of segment 24) and strongly outcurved at the tip.

(4) Spine of segment 13 of male right antennule longer than that of segment 11. Segments 15 and 16 without cuticular spinous processes, except for a minute process usually present on segment 15 of *signicauda*.

(5) Claw of right fifth leg of male not tapered, but rather evenly broadened throughout its length, with slightly constricted, rounded or blunt end.

(6) Second basipod segment of male right leg with the inner proximal portion bulging upward, or with hyaline membranous extension.

In this group, the females of *signicauda* and *moorei* resemble one another closely. The metasomal wings are well developed in all, but those of *novamexicanus* and *nudus* are individually quite distinctive with prominent inner lobes on the left side and pronounced asymmetry; those of *signicauda* and *moorei* are very similar to one another, lacking well developed inner lobes and being only slightly asymmetrical. *D. signicauda* and *nudus* may show, in lateral view, a more or less pronounced gibbosity of the fifth metasomal segment not noted in *moorei*, but this is a variable character and its absence

would not necessarily serve to distinguish *moorei* from *signicauda*. The process of the genital segment is very short in all the specimens of *moorei*, thus differing from the much more developed process observed in *signicauda*, but the possible extent of variation is not known. Considerable care should be taken therefore in separating females of these two species.

Two other leptodiptomids, *judayi* and *spinicornis*, have on the genital segment a distal process similar in structure to that of this group. The immediate relationship of these two species does not appear to be with the *signicauda* group since the males differ in several characters.

The males of the *signicauda* group are distinct from one another in several characters. The great length of the spine of segment 13 of the right antennule as shown for *moorei* (fig. 5) is also found in *nudus*; it is shorter in the other two species, though always longer than that on segment 11. *D. novamexicanus* is strikingly individual in the structure of the process of the twenty-third segment of the male right antennule. *D. nudus* has an individual character in the presence of small cuticular lobes on the ventral inner side of the caudal rami of the male. There is a striking difference in the species of the group in the position of the lateral spine of the second exopod segment of the right fifth leg, that of *moorei* being most distally placed. The approximate comparative position of this spine in the four species is shown by the following percentage figures which indicate the point of placement of the spine from the base of the segment, in relation to the total length of the segment:

<i>nudus</i>	43%
<i>novamexicanus</i>	65%
<i>signicauda</i>	77%
<i>moorei</i>	89%

The fifth leg of the male of *Diaptomus moorei* differs from the other species in the position of this spine; in the enlarged inner protrusion of the left second basipod segment; and in the subrectangular shape and medial position of the lamellar process of the right first exopod segment. In identification of leptodiptomids, care should be taken not to confuse this species with *siciloides* or *connexus*, two species closely related to one another, which also have a somewhat squarish or rectangular lamella on the right first exopod segment, and a similar process on the twenty-third segment of the right antennule. These species can be separated from *moorei* by the position of the lamella; that of *siciloides* and *connexus* is placed in the distal half of the segment, that of *moorei* is centrally placed. These species are further separable from *moorei* in both sexes by most of the characters which distinguish the *signicauda* group.

The differentiation of the *signicauda* group and of leptodiptomid species which might be confused with them is shown by the following keys.

FEMALES

(Species of *Diaptomus* (*Leptodiaptomus*) having distal process on right side of genital segment)

1. Genital segment rounded but without distinct protrusions. *spiniornis* Light
 Genital segment with distinct lateral protrusions. 2
2. Left metasomal wing with prominent inner lobe extending posteriorly beyond the outer portion of the wing. 3
 Left metasomal wing without such prominent inner lobe. 4
3. Left wing conspicuously larger than the right. *novamexicanus* Herrick
 Left wing not much larger than the right. *nudus* Marsh
4. Right wing, outer portion not posteriorly produced. *judayi* Marsh
 Right wing, outer portion posteriorly produced. 5
5. Genital segment, process reaching to near middle of anal segment or beyond. *signicauda* Lilljeborg
 Process not reaching to middle of last segment. *moorei* sp. nov.

MALES

(Species in which the process of segment 23 of right antennule does not reach beyond middle of segment 24, and has outcurved or hooklike tip)

1. Right antennule, spine of segment 11 subequal to or longer than that of segment 13. 2
 Right antennule, spine of segment 11 shorter than that of segment 13. 3
2. Right antennule, spine of segment 8 usually not enlarged (about same length as that on segment 12); metasome in dorsal view with greatest width at about the middle. *siciloides* Lilljeborg
 Spine of segment 8 enlarged (at least twice the length of that on segment 12); metasome in dorsal view with greatest width in cephalic segment. *connexus* Light
3. Right antennule, segment 23, base of process starting at middle of segment. *novamexicanus* Herrick
 This process entirely apical. 4
4. Leg 5, right exopod 2, lateral spine above middle of segment. *nudus* Marsh

- This spine below middle of segment..... 5
5. Leg 5, right exopod 1 with rounded,
distally directed hyaline process on
inner margin. *signicauda* Lilljeborg
- This segment with subrectangular,
medially directed process..... *moorei* sp. nov.

Certain synonymy among these species should be noted here. No types of *D. novamexicanus* are in existence, but it appears impossible in the study of specimens from over a wide geographical range to recognize more than one species in which the process of the male right antennule is so peculiarly modified. The names *washingtonensis* Marsh (1907) and *garciai* Osorio Tafall (1942) are therefore apparently synonyms of *novamexicanus* as has already been suggested by Kincaid (1953).

Some other synonyms in *Diaptomus* (*Leptodiaptomus*) proposed by Kincaid are not tenable. As pointed out above, *judayi* is not a synonym of *trybomi*. Likewise, *connexus* is not identical with *siciloides*, though it is not yet clear what the type of taxonomic relationship between the two species is. The fifth leg of the males are indeed very similar as pointed out by Kincaid, but the body form of both sexes (see Key above) and the metasomal wings and the urosome of the females are distinct in the two forms. The differences in the females are as great as any that commonly exist between other allied species of leptodiaptomids. These characters were not variable in any of the several collections of both forms that have been examined (including the type lot of *connexus*) so that the exact relationship of the two may not be determinable on the basis of anatomical studies alone. Attention should be given not only to their variations, but to their distribution, associations and ecology, particularly in the geographical areas in which they co-occur. Much of significance applicable to the taxonomy of the genus may be learned from study of cases such as these, so it is important that their differences not be ignored or obscured as they would be if accepted as synonymous without critical appraisal. Therefore, I have retained the two names and separated them as species in the key in the forthcoming revised edition of Ward and Whipple's *Fresh-Water Biology*, in which figures illustrating the differences are included (M. S. Wilson, In Press).

Diaptomus siciloides has a very broad distribution over the North American continent, having been reported from most areas except the extreme north and the east coast. In Louisiana, it is the species listed by Moore (1950) as *Diaptomus* sp. from Lake Providence. *Diaptomus connexus* was originally described from Kern County, California by Light (1938) and additional collections in the Light accession in the National Museum indicate that it has a much wider distribution in the southwestern portion of the continent. It has been identified by Dr. Light from other California localities, from Nevada, Colorado, New Mexico and Lower California. Both species

have been found in lakes, reservoirs and ponds. A Mexican form named *cuauhquemoci* by Osorio Tafall (1941) is also involved in the synonymy of one of these species. It may be referable to one or the other, but examination of whole topotypic specimens would be necessary to determine the exact identity.

Of the species of the *signicauda* group, *signicauda* and *novamexicanus* are known to be very common in the western part of the continent, and particularly so in the Rocky and Cascade mountains and the Sierra Nevadas. *D. signicauda* has been reported from Iowa (Stromsten, 1920) which is outside its apparent normal geographic range. *D. novamexicanus* is perhaps more widely distributed than *signicauda*, being common at sea level in California, and extending into Mexico. The record of this species from the Yucatan Peninsula by C. B. Wilson (1936) would appear to include another species since the figures given for the fifth legs of both sexes are neither *novamexicanus* nor referable to the subgenus *Leptodiaptomus*. The process of the male right antennule is similar to that of *novamexicanus* and may have been drawn from that species.

These two species have not yet been reported or collected from the far northern areas of the continent, but *nudus*, which also occurs in the Rocky Mountains of both the United States and Canada, may have an Arctic-alpine distribution pattern. It was found recently in a collection made for me from a tundra pond at Bethel, on the western Bering coast of Alaska.

The occurrence of the new species *moorei* in Louisiana and Texas, suggests that it should be looked for in the Mississippi Valley, other southern states of the Gulf of Mexico area and in Mexico and Central America.

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